Overview of Thailand case study for higher blend of biodiesel

Nuwong CHOLLACOOP
Head, Renewable Energy Laboratory
National Metal and Materials Technology Center (MTEC)
nuwongc@mtec.or.th

The 1st APEC Workshop on Guidelines toward High Biodiesel Blend Diesel (eg B20) Specification in the APEC Region

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CC405, Thailand Science Park, Thailand
Outline

• Update on current national project (2016-2018) “Implementation of Higher Blend of Biodiesel” funded by ENergy CONservation (ENCON) fund via Department of Alternative Energy Development and Efficiency (DEDE)
Overall Targets

**By 2021**

- Renewable Energy in total energy consumption: 25%

**By 2036**

- Renewable Energy in total energy consumption: 30%

**Electricity**
- 13,927 MW
  - (20.11% of Electricity Demand)

**Heat**
- 9,800 ktoe
  - (36.67% of Heat Demand)

**Fuel**
- 9 MLPD Ethanol
- 7.2 MLPD B100
- 3 MLPD Advanced Biofuel
- +4,800 TPD of CBG
  - (25.04% of Fuel Demand)
Project Details

Biodiesel upgrading: H-FAME

Testing of B10 from H-FAME

1. %MG from precipitation test
2. Fuel quality survey
3. TT of H-FAME to local BDF producers
4. Materials compatibility with B10
5. 100,000km on-road test with B10/H-FAME
6. Large-scale demon with B10/H-FAME
Project plan to obtain Thailand’s data
Procedure

Prepare biodiesel with different amount of mono-glyceride (%MG)

Test following JAMA ASTM D7501-12a
ASTM D4625-14

Place samples at temperatures of 5, 10, 15 and 25 °C with 2 weeks duration (5 times sampling)

Place the samples at room temperatures and in water baths at 25 °C for 4 hrs (if some solid phase) or 2 hrs (if liquid phase)

Filter the samples by fiber filtration paper of 0.8 micron pore size under the vacuum (75-80 kPa), and weigh precipitates on filter paper (if any)

mono-glyceride (wt%)  
Low (<0.2wt%)  High (>0.5wt%)

B0 (Diesel)  B100 (upgraded FAME)  Palm FAME
**Oil Sampling Plan**

10 Oil Depots

- Diesel blend (Bxx) or/and Biodiesel (B100) or/and Base diesel (B0)

50 Petrol Stations

- Diesel blend (Bxx)

12 Authorized Biodiesel Producers

- Biodiesel (B0)

**Sampling Periods**

- Rainy season (June-July 2017)
- Winter (November-December 2017)

**The total samples**

- 1. 120 diesel samples
- 2. 24 biodiesel samples
# The properties to be tested

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water content (EN ISO 12937)</td>
<td>≤ 300 mg/kg</td>
<td>Water content (EN ISO 12937)</td>
<td>≤ 500 mg/kg</td>
</tr>
<tr>
<td>Oxidation stability (EN 15751)</td>
<td>≥ 35 hr</td>
<td>Oxidation stability (EN 15751)</td>
<td>≥ 10 hr</td>
</tr>
<tr>
<td>fatty acid methyl ester (EN 14078)</td>
<td>≤ 7%vol. and not less than the specification by Department of Energy Business*</td>
<td>Acidity (ASTM D664)</td>
<td>≤ 0.50 mg KOH/g</td>
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<tr>
<td></td>
<td></td>
<td>Mono-glyceride (EN 14105)</td>
<td>≤ 0.70 by weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cloud point (ASTM D2500)</td>
<td>Not specified in notice of the Department of Energy Business</td>
</tr>
</tbody>
</table>

*Notation: abide by notice of the Department of Energy Business*

Sample’s volume of 5 L/time

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*Sample’s volume of 5 L/time*
Technology transfer of biodiesel upgrading process to the demonstration plants

1. Select two biodiesel manufacturers that are ready and willing to receive technology transfer on biodiesel-upgrading technology

2. Install and produce upgraded biodiesel from the technology-transfer process

3. Test the system and operate biodiesel upgrading process

4. Check upgraded biodiesel quality to meet low MG content

5. Produce high quality biodiesel to support on-road test by light-duty vehicle and demonstration of B10
Plan for B10 testing (using upgraded BDF)

Lab scale
Material compatibility test

Field test
Engine compatibility and wear test
(On-road durability test, 100,000 km)

Actual use
B10 demonstration in transportation sector
Immersion test consists of metal and non-metal parts.


Preparing the specimens

Weighing and packing the specimens

All specimens

Weighting after immersion

Replacing the test fuels

Weighting (initial)
Engine compatibility and wear test

Selecting vehicles

Inspecting and preparing the vehicles

The injection rate test by the injection nozzle tester

Performance, emission and fuel consumption test on a chassis dynamometer

Starting the test at 0 kilometer

Accumulated distance (kilometer)

Collecting engine lube oil

Acceleration test on the field

Collecting the data
- Problems
- Maintenance record
- Driving condition

Evaluating and inspecting the vehicles
Vehicle selection

All brands for pick up truck registered in Thailand

1. CHEVROLET   2. CITROEN   3. DAIHATSU   4. DATSUN
6. DFM         7. DFSK       8. DODGE      9. FARGO
11. HINO       12. HONDA     13. HYUNDAI   14. INTERNATIONAL
16. JEEP       17. KIA       18. KIA MASTER 19. LAND ROVER
21. MITSUBISHI 22. NISSAN   23. OPEL       24. PEUGEOT
26. SUZUKI     27. TATA      28. TOYOTA    29. TRIUMPH
31. VOLKSWAGEN 32. WILLYS   33. WULING

Choosing from market share
ISUZU
TOYOTA

B10 demonstration in transportation sector

Fuel: B10 from 10% of H-FAME blended
Volume: 120,000 L

Organization interested to participate in this project:
- Kasetsart University
- Rajamangala University of Technology Thanyaburi
- Royal Thai Navy
- NSTDA
Acknowledgements

Deeply appreciate

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- all of the research participants of NSTDA/MTEC, TISTR, KMUTNB, WASEDA U. and AIST for their contributions to this Project.
- ISUZU Thailand group for their kind supports on the on-road tests, and PTT, Bangchak and Thai oil for supplying the FAME (B100) and petro diesel (B0) and for measuring the fuel quality.
- Department of Alternative Energy Development and Efficiency (DEDE) to conduct national project on H-FAME evaluation under patronage of ENergy CONservation (ENCON) fund

Thank you for your kind attention